Blitz QFD® - The Lean Approach to Product Development

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Abstract
Prominent drivers of the quality improvement process are to fix problems either from customer complaints or internal discoveries, or to address opportunities either from unmet customer needs or new solution concepts. While fixing problems typically looks at products (including services, software, internal business processes) that currently exist and about which much is known, addressing opportunities is typically about products that do not exist yet and about which there are many unknowns. These two approaches are split into Lean Sigma projects for existing products and Design for Lean Sigma (DFLS) projects for new products. This paper will discuss a modern approach to DFLS using Blitz QFD®, a method developed by the not-for-profit QFD Institute to eliminate wasted efforts by focusing resources first and best on what matters most to customers.

Key Words
Design for Lean Sigma, Design for Six Sigma, QFD, Blitz QFD®, Voice of Customer, AHP

Introduction

QFD was developed in Japan during the 1960s[1] (during its period of modernizing traditional approaches to quality management) to assure that not only is negative quality prevented but positive quality is enhanced. In other words, a lack of problems does not guarantee everything is right; i.e. nothing wrong ≠anything right. Figure 1 Nothing wrong ≠ anything right

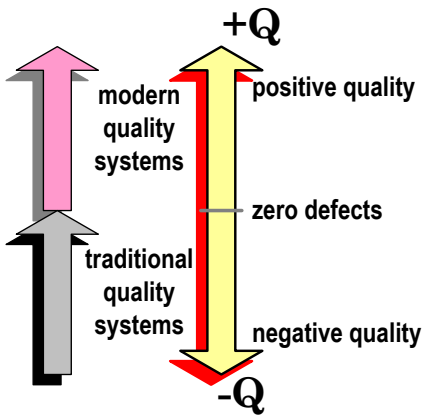


Figure 1 Nothing wrong ≠ anything right

The concept was extraordinary at the time. Traditional approaches to product design were typically driven by technical advancements that often failed in usability or made downstream manufacturability or service delivery a nightmare. The QFD approach recommended that:

- Assuring quality is a team approach.
- Customer driven quality required acquiring and analyzing the Voice of the Customer (VoC) to determine what matters most.
- Different customer segments have different needs with different strengths. It is important to get an accurate priority from them.

QFD journeyed to the U.S. in the early 1980s at the behest of the automotive parts industry. Early QFD efforts through the 1990s focused on creating elaborate matrices or "houses" to help the multi-functional teams visualize the complex cause-and-effect relationships among users, developers, builders, and deliverers of products and services. Mathematical models were incorporated so that market priorities could be maintained and tracked as they drove priorities for engineering and manufacturing.

The Japanese automotive quality effort continued its influence into the 21st century. Customer focus was joined with process efficiency called Lean Thinking, which demanded examination of all activities to remove wasted effort. QFD, appropriately, became leaner to assure that maximum value could be realized with a minimum of resources. This lean approach is called Blitz QFD®.[2]

QFD essentially means that to deliver quality to customers that will add value to their work and lives, efforts must begin early on. If quality assurance waits until after design and development have been completed and product moves into the manufacturing or implementation phase, it may be too late to make substantive changes that could affect market acceptance or first-pass quality. Thus, QFD recommends that the quality professional be involved as early as the marketing and voice of customer acquisition phase.

Classical QFD

Early deployments of classical QFD prescribed a large number of inter-dependent matrices. A 1978 example from the Toyota Lite Ace mini-van project identified four major improvement opportunities in steering, rust prevention, sliding side door, and a moon roof. The rust study (actually a reliability deployment and not a quality deployment) deployed to 16 levels of matrices and took some two years to complete. This started with a matrix of 42 tertiary customer needs (needs translated from customer needs by the car companies and then translated to product needs for the supplier) and progressed through 16 downstream matrices finishing with a matrix that translated operation standards into work control conditions for rust preventing undercoat spraying. In other words, the classical QFD approach goes end-to-end from customer needs to manufacturing controls.

This study became one of the foundations of automotive supplier QFD in the U.S. and elsewhere, but its magnitude was hard for beginners to grasp. A Fuji-Xerox study that used just four cascading matrices was adapted by American automotive suppliers to address common reliability concerns and became known as the "4-phase" model of QFD shown in Figure 2. The first of these phases, the House of Quality, has since become synonymous with QFD. Many of the early adopters in the US allowed these charts to grow to sizes that approached one million intersecting cells. On being shown one of these charts, Dr. Akao avoided blessing the efforts of one automotive team by praising "how straight the lines were." (Japanese charts were typically drawn by hand at that time and this was one of the first to be printed on a plotter.) The 4-Phase deployment of product requirements through the four phases to pro-

cess controls is logical and easy to learn, and quickly became *"the way"* to do QFD in nearly every country outside Japan.

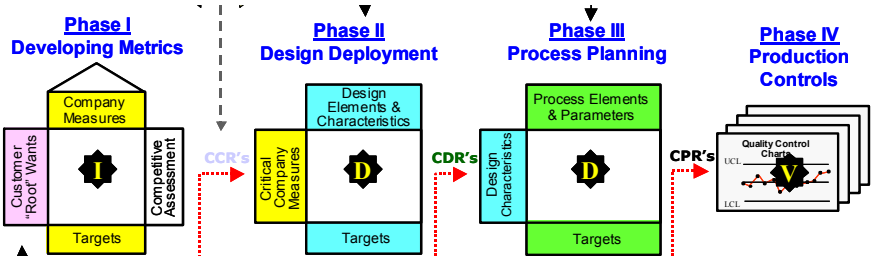


Figure 2 4-Phase QFD model for auto part suppliers

However, not all companies using QFD are auto part suppliers building to product requirements and specifications from an OEM automaker. Many companies using QFD design and manufacture end products, services, software, food products, etc. Even first and second tier auto part suppliers in today's world have major design responsibility. In such cases, the 4-Phase QFD model may not cover all the necessary deployments; that is, it does not assure quality end-to-end from marketing to commercialization. Japanese companies, in fact, rarely use this model, preferring instead to custom tailor a set of charts and tools relevant to their management style and product.

Blitz QFD®

The Blitz QFD® approach developed by Richard Zultner [3], co-founder of the QFD Institute, in the mid-1990s to develop a faster approach to QFD for time-to-market sensitive and fast-changing technology projects often found in IT and software development. Modern QFD was built on the foundations of Blitz QFD® which offers four significant improvements over classical QFD for companies involved in the end-to-end design, development and deployment of products, processes, services and systems:

1. Efficiency & speed of analysis: Blitz QFD® offers a more efficient use of time by replacing most, sometimes all, matrices with more efficient tables that track only a small number of the most critical customer needs end-to-end through the analysis, design, development, and build phases. The use of hierarchy diagrams has enabled the structure of needs to be established, i.e. requirements at the same level of scope are considered rather than mixed levels. The traditional House of Quality matrix, on the other hand, is only the deployment of the requirements analysis phase into design (shown as Phase 1 in Figure 2 above). Additional matrices may be need at various stages of the end-to-end cycle to give a visual summary of key requirements. Figure 3 depicts how the Blitz QFD® process delivers an end-to-end requirements flow down from marketing to commercialization on a few key customer needs, and why the House of Quality (which is all most practitioners even attempt) contains only one of several necessary interfaces.

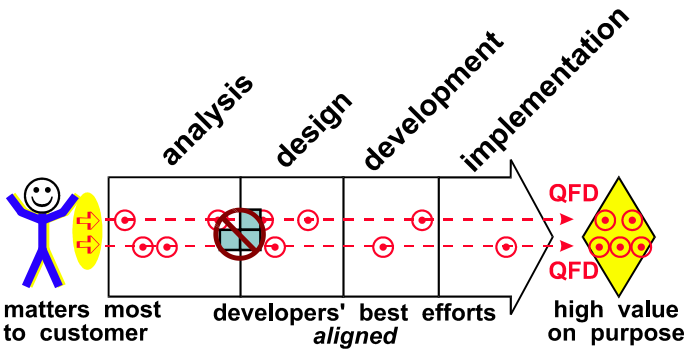


Figure 3 Blitz QFD® and why House of Quality alone is insufficient

2. Establishing True Customer Needs and Values: One problem with classical QFD was that suppliers, particularly automotive suppliers, were reliant on their OEM customer to understand their customers' needs and priorities. Unfortunately, this was not always the case and so even suppliers with well developed components suffered if the finished vehicle did not sell well. Even in IT, for example, system suppliers often assume that their customers' needs and priorities are properly understood and communicated to them at the start of projects. Thus, a structured front end analysis and prioritizations of the business and project goals, customer/market segments and value chains was added to the analysis phase in modern QFD in order to ensure a clearer articulation and understanding of critical customer needs and their priorities was established.

3. Relative/Proportional values of priority: Traditional QFD, as it developed in 1960s Japan in the pre-calculator age, was done by hand. A simple five rating point scale was adopted that could be calculated with an abacus. Although it resembles the five-point market research Likert Scale, the QFD scale is used to determine importance and correlation, not agreement with a statement. Because the five-point scale is an ordered scale, that is the interval between 1 and 2 is not necessarily equidistant to the interval between 4 and 5, statistical analyses are limited to mode and median calculations. This means that many of the math operations in traditional QFD violate this limitation and the results have questionable meaning and the best that can be achieved is a rank order prioritisation. The better approach, used in modern QFD, is to develop ratio scale priorities using the Analytic Hierarchy Process (AHP)[4] which ensures they are relative e.g. a project goal contributing 50% to meeting a business goal is twice as important as a 25% goal.

4. Lean design – effort focused on critical customer business goals and requirements. Since the 1960s, right-sizing has lead most organizations to cut staff to the leanest possible levels. Add to this the pressures of global competitors, multi-tasking across projects, compressed time-to-market and the demands of rapidly advancing/disruptive technologies, and new product

design and development teams are hard pressed to find time to do all the QFD they should. Modern QFD has included Blitz QFD® as a matrix-free/lean approach to first deploy only the most important needs of the customer, end-to-end throughout all the quality assurance phases, as shown in **Error! Reference source not found.** above. In the Toyota rust study, for example, Blitz QFD® would cherry pick only the critical few concerns of all 16 matrices.

Blitz QFD® Process

Because the Blitz QFD® process is a lean one, it must have clear focus from the start. What redundancies there are support clarifying purpose and direction before moving to the next step, as retracing steps is viewed as wasted effort. If QFD is to assure quality end-to-end throughout the product development project, it should begin at the project definition phase where the business goals and project goals are defined and quantified. This is the voice of the business (VOB). The most up-to-date release of the generic Blitz QFD® process is shown in Figure 4. However, experience has shown that this generic process is just that – each company should have its product development process reviewed by a QFD specialist, such as a QFD Master Black Belt® or QFD Red Belt® to determine the best subset and sequence of QFD tools for their organization structure and industry.

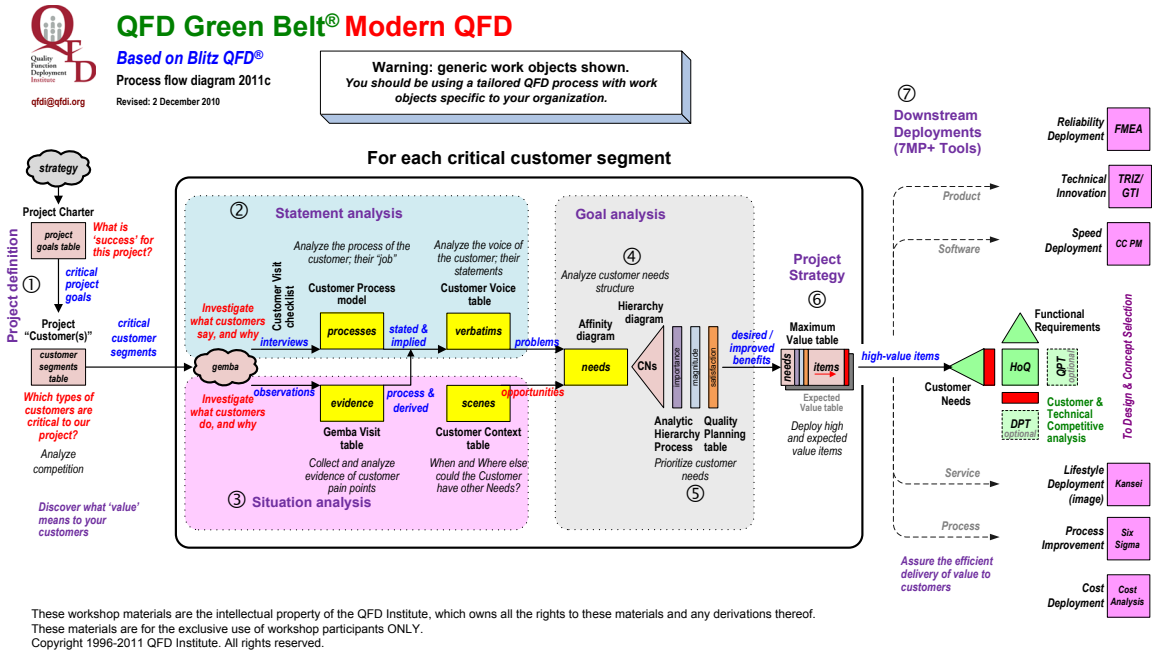


Figure 4 Generic Blitz QFD(R) process flow diagram.

Note that the process is divided in into seven main sections, each comprised of several tools, the output of one becoming the input of the following tool, in classical QFD fashion. Note, too, that the classical QFD House of Quality (HoQ) is in section 7 as an optional step should that level of detail be required. If the HoQ and other matrices are required, practitioners should rest assured that their Blitz QFD® efforts are not wasted, but are fully upgradeable to classical QFD. By definition, the Blitz QFD® results will be the top priority items in any subsequent matrix. The next sec-

tions will describe each of the steps in the generic Blitz QFD® flowchart and illustrate with examples. Because this paper is addressed to a general quality manager audience, examples will be taken from various industries to better represent the adaptability of these tools under different conditions. Readers seeking a continuous flow of tools in a single application as well as custom tailored examples are directed to the author's personal website www.mazur.net where dozens of both classical and modern Blitz QFD® cases are available for download.

Blitz QFD® Tools

Section 1. Project Definition Phase

Many new product development projects are tied to a product portfolio strategy to which they must make some contribution. Usually, an organization has more projects than they have resources so they go through some project prioritization and selection process. In QFD, the AHP alternatives selection mode is recommended to allow for both objective and subjective evaluation criteria to be used in the evaluation. These criteria often are derived from a strategic policy, which is recommended to be formulated and deployed using a quality methods known as Policy Management (Hoshin Kanri in Japanese).[5] From the strategy, a Project Scope Boundary table may be used to better define what is in and out of scope, in order to better prevent scope drift and creep. These approaches are beyond the scope of Blitz QFD® but are included in the QFD Black Belt® program of the QFD Institute.

Project Goals Table

"If this project is successful, our organization and stakeholders will benefit how?" This helps the team focus on the "voice of the business." Management invests in certain projects over others and must make this selection according to some criteria related to benefits to the institution. If these are not explained thoroughly to project team members, disagreement can cause confusion later in development process. The project goals table in Table 1. is often used to summarize the project charter but with a quality twist that asks how these goals will be measured, where they are today and need to go and by when, and who will judge whether they have actually been met. This last column can be important if the judge of success has a different set of metrics.

Table 1 Project Goals table for a Customer Relations Management software program.[6]

#	Goal Statement, including target.	How measured?	Time frame	Who judges success?	Means (optional)
1	Increased return on cost of sales - profit (25% Increase)	Sales / £ Spent on Campaigns; Sales/ £ New Service Development; Cross Business Line Sales Returns	6 months	CFO Sales & Mkt. Dir.; Line of Bus. Mgr.	Via better targeting of campaigns and product enhancements; company customer information made accessible to campaign managers in timely manner; New Sales Opportunities Identified Corporately; Collation of Sales Opportunities/ Trends @ corporate level
2	Customer Experience of the Brand Improved - treated as individuals/ business that are understood by the organization, wherever they are.	# Customer complaints about poor targeting 'why me?'; Increased cross-product sales to individuals/ businesses; Compliance with Data Privacy & Export Legislation Demonstrated	6 months	Customers Sales & Marketing Director Chief Security Officer	Corporate Profile of individual customers or businesses made available; Compliance Matrix for Information Export Legislation vs Information Architecture Demonstrated
3	New system costs no more to own and operate than existing systems. (Opex </= to Existing)	Cost /user / month of new system compared with existing	Immediate	Line of Bus. Mgr. Bus. Ops. Dir. Client IT Mgr.	Components of Total Cost of ownership of existing systems
		Speed to adopt new standard processes			

Customer Segments Table

Who are our customers (may include internal and external stakeholders)? What is the value chain of customers from our facility to the end user? Customers should be defined based on their interactions with the proposed product, process, or service. The Customer Segments table shown Table 2 in should be customized for each application but will typically describe these kinds of customer attributes. Additional columns can include financial and market metrics as well as competitive preferences. From this, key customers can be prioritized using methods like AHP.

Table 2 Customer Segments table for multi-disciplinary hospital clinic.[7]

Customer Segment	Who uses process	What disease condition	What is process used for	Where	When	Why	How
Pediatric pt	Pt and family	spinabifida	improve interaction between visting physicians	CMH main campus	daytime ambulatory clinic	visiting physicians do not have sufficient time to interact	develop new tools to better evaluate treatment options
Visiting physicians	Provider	mild traumatic brain injury				Share medical records from urban to rural facility members	
Nursing staff		muscle and nerve					

Section 2. Statement Analysis

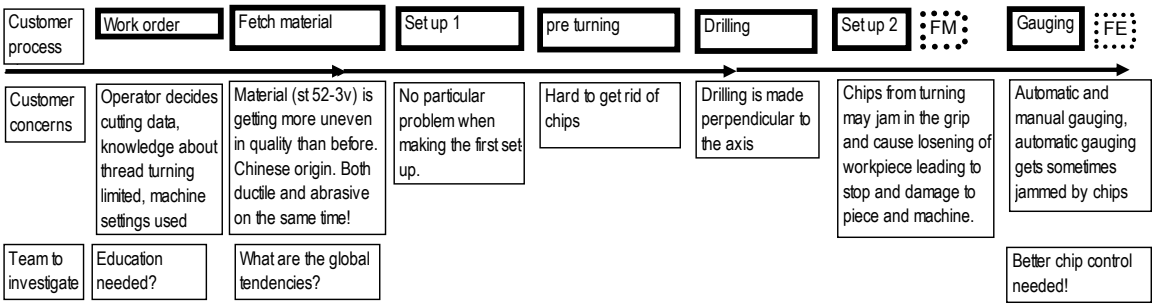
In the generic Blitz QFD® model, the next step is get the voice of the customer. QFD employs several techniques for capturing the voice of the customer, such as interviews, questionnaires, and focus groups. As the team typically scripts these survey instruments, they tend to focus on things we know and want to validate and things we know we don't know and want to find out. One of the unique QFD tools is called *gemba* which is a Japanese term indicating the "crime scene" or the place where first hand evidence is gathered. In the quality movement, this usually refers to the plant floor where a problem has occurred and needs to be investigated by the experts. In new product, service, and process development, however, there is no plant floor or problem to investigate yet, so the *gemba* shifts to the customer's "plant" and his problems that need to be investigated. In the *gemba*, we can observe the customer *in situ* as they go about their life and work and we can identify issues through behavior and language that the customer themselves might not even be aware of or think to mention in an interview or focus group. Thus, *gemba* gives access to what we don't even know we don't know.

Customer Process Model

Since many customer processes are complex, it is often easier to get customer input if we can parse their activities into discrete steps and get feedback about them. We can also ask the customer which step in the process is most in need of improvement from their perspective as well as what is working well and should not be changed. Things gone right (TGRs) are candidates for "expected quality" in a Kano analysis,[8] another QFD Black Belt® tool. Thus, we are asking the customer to give us process, content, and value in one diagram. The annotated Customer Process model shown in

Table 3 also ask the customer to indicate where their failure modes occur and where their failure effects are experienced. Similar to traditional failure mode and effects analysis (FMEA), this focuses on how customers fail to perform their work or life, rather than failures in our products.

Table 3 Customer Process Model of a machining center.[9]



Customer Voice Table

The customer comments gathered from each step of his/her process often include suggestions on how we could improve our product. Depending on the business, customer suggestions can often get technical, typically referencing existing solutions, but also pointing to new functions and features the customers believe would benefit them. QFD teams frequently report that when customers suggest adding features to a product, they are usually out-of-date, focused only on their situation, and in some cases misleading; and fulfilling the requirement can still lead to dissatisfaction. This suggests that customers can believe a feature will benefit them, even if it won't. One of the skills required to do QFD well is to translate the "voice" of the customer (narratives) into true customer needs, independent of the product features. These narratives address many customer issues, including needs, requirements, improvement suggestions, complaints, etc. Then, later in the development and implementation phases of QFD, we can better define and design those features based on emerging technology. In modern Blitz QFD®, the Customer Voice table is used to translate customer narratives into customer needs. This table should be customized according to the customer and project. Table 4 shows an example from a medical center.

Table 4 Customer Voice table translates customer narratives into true customer needs.[10]

narrative or observation (from CRM, interviews, questionnaires, focus groups, gemba)	customer "job" or task	product/service/ process attributes	customer need
Before tech administered bone density test I HAD to look at pictures of her dog. VERY inappropriate.	Having exam	No personal pictures	Need to have time valued; Need personal attention; need professionalism, Need focus to be on me, Need to reduce anxiety
Groggy after MRI - No time to 'wake up' - ushered right out. Offer headphones w/music or news.	Having exam; MRI finished - changing	Headphone w/music or news	Need time to be fully alert; need technologist to be sympathetic to condition; Need alternative calming during procedure, Need to not be rushed, Need to be treated as individual, Need distraction, Need staff to be sensitive to individuals

Section 3. Situation Analysis

Tasks in the customer process that are particularly problematic are key to driving a new product's success. Asking customers to accept a new product is asking them to change their current processes, equipment, etc. To do so, customers take on cost and risk such as new operating procedures, training, service and maintenance, etc. To offset that cost and risk, the new product must offer benefits that are orders of magnitude better than what they currently have. Thus, improvements that marginally improve what is already good enough or address minor dissatisfactions are rarely sufficient to sell a new product unless the customer was ready to change anyway. Thus, when the customer identifies for us a major failure mode in his/her process, a real headache that prevents them from being more productive and making more money, we must go beyond the narrative description of the problem (the obvious and spoken need) to explore more deeply the hidden, unspoken needs. The obvious is equally easy for competitors to gather, but with a *gemba* visit to the failure point, we can learn the unknown unknowns and thus create truly differentiating solutions.

Gemba visits allow us to utilize all our five senses to gather information and to reflect and clarify what outcomes the customer expects and how they measure satisfaction. The *Gemba* Visit table is used to document the sensory inputs, our reflections on them, and the customer outcomes and metrics. Outcomes from the *Gemba* Visit table can also flow into in the Customer Voice table to be translated into customer needs.

Table 5 *Gemba* **Visit table for a machining center.**[11]

Gemba Visit Table					
Interviewee: Operators and technicians				**Interviewer(s):** Mr X and Dr Y	
Place: XXXXX, Sao Paulo, Brasil				**Date and Time:** May 14, 2008 , 12pm-16pm	
Contact info: through Mr Z at Sandvik do Brasil					
Interviewee Characteristics (*memorable): Very dynamic and outspoken (this is used to make it easier to remember the interviewee)					
Environment: threaded tube production plant					
Process Step	**Observations**	**Verbatims**	**Documents**	**Notes**	**Clarified items**
Threadening	**Uses uncoated inserts.**	**Fast delivery of special important!**	**Drawings on site**	**Value of tube very high in comparison to insert.**	**Fast delivery of sp ecial essential (weeks)**

Customer Context table

Customers often operate in more than one mode, and when designing a new product, it may be helpful to consider other modes of operation, including future ones. Since this information often addresses customers' strategic initiatives, no publicly available examples can be shown.

Section 4. Goal Analysis

This section helps clarify what goals the customer seeks first, and therefore what direction the new product development must take. This section has two parts - finding missing customer needs, followed by quantifying the customer needs.

Affinity Diagram

The output of the customer voice table is a list of customer needs. They often contain both abstract and detailed needs that should be structured to avoid double counting later on. The structure can also be used to discover missing needs. The first step is to get the customer to group and label their needs in a way that makes sense to them. Readers who may have used the affinity diagram on internal processes should be careful not to "coach" when customers do this. An example from a health insurance company is shown in

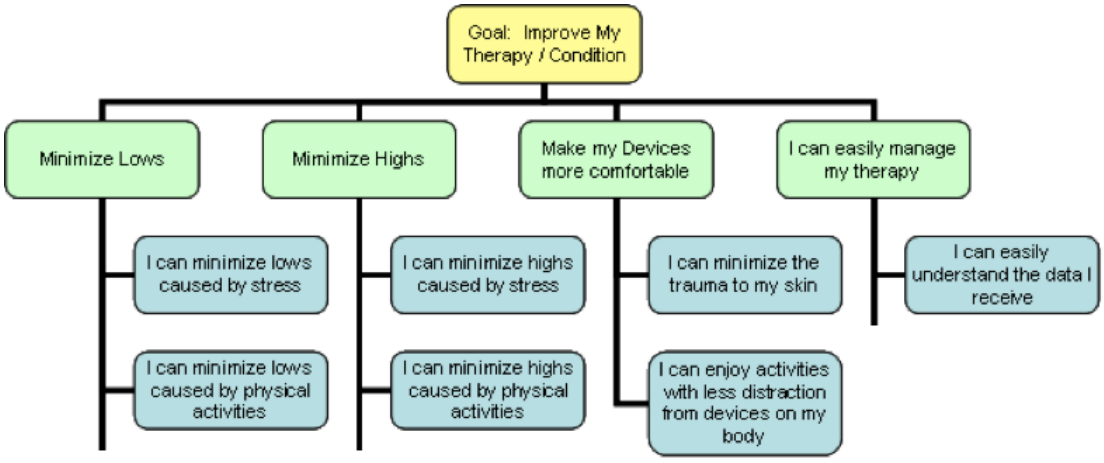
Table 6 Affinity diagram from health insurance provider.[12]

Employee Satisfaction which includes these statements: "My Employees appreciate the benefits I provide for them" "Keep my Employees and their Families Healthy" "My Employees know what they are entitled to" "My Employees have Peace of Mind"	Health Care Knowledge which includes these statements: "I Feel Good about the Plan I Choose" "My costs are predictable year over year" "I Understand how all the Plans Work" "I Want My Employees to Understand the Value of the Health Coverage I'm Providing for Them"
Business Efficiency which includes these statements: "Attract Highly-Qualified New Employees" "Save me Time and Effort" "Retain My Best Employees" "My Boss Knows I'm Diligent with the Company's Money" "Keep my Employees Productive"	Relationship with the Carrier which includes these statements: "The Carrier Acts as My Partner" "I Feel Valued by the Carrier" "I Know I'm Getting the Right Answer when I'm Talking to Customer Service"

Hierarchy Diagram

A Hierarchy diagram is used to perform three tasks: (1) correct the levels of detail, (2) find missing data, and (3) prevent common errors in subsequent steps such as the House of Quality. The Hierarchy diagram of customer needs is the basis for analysis to uncover the latent needs that are implied by the needs we have so far.

Table 7 Hierarchy diagram for a medical device.[13]



Section 5. Quantification

A properly organized and prioritized hierarchy can tell us if we have sufficient needs to satisfy the customers. In other words, do we have enough needs that the cus-

tomer would be satisfied with the product, if we delivered them? We may also ask customers how they measure their degree of satisfaction.

Prioritization

Once the customer needs are identified, the next step is to determine which need to address first. It is not uncommon that the time, budget, or staff assigned to a project will change (usually reduced) during the course of a project. Thus, the most important customer needs should be addressed first. Prioritization in multi-criteria decision-making was advanced by the research of Dr. Thomas Saaty in the 1970s at the U.S. Department of Defense and later at the Wharton School of Business at the University of Pennsylvania. Saaty found that decision makers facing a multitude of elements in a complex situation innately organized them into group sharing common properties, and then organized those groups into higher level groups, and so on until a top element or goal was identified. This is called a hierarchy and when making informed judgments to estimate importance, preference, or likelihood, both tangible and intangible factors must be included and measured.

Modern QFD, uses Saaty's Analytic Hierarchy Process (AHP)[14] technique to manage this process in a manner that captures the intuitive understanding of the participants and also yields mathematically stable results expressed in a numerical, ratio scale. A numerical, ratio scale is preferred for the following reasons:

- Numerical priorities can be applied to later analyses to derive downstream priorities. This will be important in guiding the developers and implementers of new solutions.
- Ratio scale priorities show precisely how much more important one issue is than another. Ordinal scales only indicate rank order, but not the magnitude of importance.
- Numerical scales can be tested for judgment inconsistency, sensitivity, and other useful properties. As AHP does not require rational responses, an inconsistency check will quantify and identify judgment inconsistencies by looking for instances of a>b, b>c, but c>a, etc.

Customers are asked to vote on the importance of their needs in pair-wise comparison, using a verbal scale. This is because with customer needs, it is hard to get numerical measurement due to the subjective nature of the data. Human stimuli and response to "noticeable differences" is quite good, however, when comparing two items at a time. This is easiest when done on a 5- or 9-level[15] scale of equally important, moderately more important, strongly more important, very strongly more important, or extremely more important. When we have more than a few customer needs, it is helpful to express priorities with numbers.

Perhaps the most common way to prioritize is use a simple ordinal1-5 scale, where 1 is for the least important items, and 5 for the most important. This is a way of placing the items into five categories or "buckets". We know the items in bucket #5 are

more important than those in bucket #4, but we don't know how much more important. And we know all the items in any one bucket are not really equally important, but because they're all in the same bucket, they are considered to have the same priority. We also know that although the labels on the buckets are numbers, the items in bucket #2 are NOT twice as important as the items in bucket #1. We cannot use the bucket labels as ratio-scale priorities, so we cannot multiply by them. If you just need to sort items into a few categories, this approach will do that. For customer needs where then could be many items in many categories, we want a more accurate approach. We need to know how much more important any item is compared to any other item. This is a *ratio scale priority*. Ratio scale numbers are preferred to ordinal scale numbers because only ratio scale numbers can be added, subtracted, multiplied, and divided. These mathematical functions are not allowed on ordinal scale numbers and the results will have no statistical meaning.

In the example in Table 8, customers use the verbal scale above and a numerical equivalent is inserted into the decision matrix. AHP uses an eigenvector of the decision matrix to closely approximate priority.

Table 8 AHP grid to prioritize customer needs from a health insurance company.

Improve business efficiency	I can hire best new college graduates	I can attract best employees from competitors	I can keep star employees from leaving	normalized columns			sum	avg
I can hire best new college graduates	1	3	5	0.652	0.714	0.455	1.821	**0.607**
I can attract best employees from competitors	1/3	1	5	0.217	0.238	0.455	0.910	**0.303**
I can keep star employees from leaving	1/5	1/5	1	0.130	0.048	0.091	0.269	**0.090**
	1.533	4.200	11.000	1.000	1.000	1.000	3.000	1.000

Quality Planning Table - Magnitude and Targeting Customer Satisfaction

Customers measure their perception of satisfaction differently than we do. Customers measure in terms of how well their needs are met while we measure in how well our product performs. Customers may have a desired level of satisfaction, but will they settle for something less, and if so what is the minimum acceptance level? Is there a level of satisfaction above which customers no longer perceive benefit? What are competitors offering? The Quality Planning table is the tool to document and quantify these levels. Since this information often addresses strategic initiatives, no publicly available examples can be shown.

Section 6. Project Strategy

Once the customer needs are prioritized and quantified, Blitz QFD® sets about defining the solution to meeting the highest prioritized needs first and with best effort. If the QFD team is constrained in people, time, and money (and who isn't?), then this

may be the final step in the QFD process. If greater detail is required and Houses and matrices are to be later deployed, this will get the team moving right away on the most important design elements while the larger charts are being investigated and structured. Thus, it is recommended for all QFD projects since the results will be top priorities in all subsequent charts as well and will not need to be reexamined.

Maximum Value Table

The Maximum Value (MVT) table takes key customer needs and drives them forward to the various dimensions of design that must be aligned end-to-end in order to assure quality and customer value. The MVT does not of itself kick-off the whole project, but illustrates where we need to do our best in the design and delivery of the product. At this point it is permissible to "over explore" as we can cut back later depending on time, availability of resources, and budget. The columns start with the same set used in the CVT, but new columns may be added to assure coherent end-to-end activity to deliver value to the customer. The MVT may show us areas that have greater complexity or uncertainty, and where more complex matrices need to be done between two design dimensions and at what level of detail. The example in Table 9 shows an early definition of a software solution for communicating medical information to patients. More columns related to SCRUM software development are added as the development, testing, and launch progress.

Table 9 Maximum Value table for multi-disciplinary clinic.[16]

Customer			Analysis	Design	
			Functional Requirements	Design Requirer	
task	problems	needs	characteristics & capabilities	solution technology	
Pre clinic	Parents may or may not provide goals for their child	Patients and parents need to participate in their care	Capability to help parents to set goals for their child. Capability to help parents communicate goals to provider prior to clinic.	Selectable modality of communication: email, written, verbal; signing, and on line. Goals should be entered electronically prior to the clinic visit. Ability to communicate goals in family's native language.	
			Capability to help parents understand care requirements for their child, i.e. how to feed, how to give meds, monitoring of equipment, troubleshooting equipment.	Telemetry for equipment to communicate directly to hospital.	
			Capability to help parents	Follow up nurse	

Section 7. Downstream Deployments

For some projects, the Maximum Value table may grow too large or complex, indicating that additional QFD tools will be needed. Classical tools such as the House of Quality and other matrices, TRIZ for technical innovation, lifestyle deployment for emotional quality, speed deployment for project management and other QFD Black Belt® tools may be integrated into the process. Since this paper focuses on Blitz

QFD®, interested readers are pointed to other articles and case studies on www.mazur.net.

Blitz QFD® vs Classical QFD

The Traditional QFD matrix approach developed in the late 1960s produced a significant improvement in the effectiveness of aligning product designs to the customer requirements. The matrices gave rank order prioritization of customer and design requirements, but were prone to over complication and creation of matrices containing all identifiable requirements. This reduced the effectiveness of the matrices as it resulted in the critical-to-quality requirements being hidden thereby defeating the objective of QFD. The arithmetic used in the original QFD also meant that relative importance of requirements could not be established – only rank order importance.

Blitz QFD® addresses these issues by applying structuring methods to speed up the process of identifying the most important requirements worthy of more in-depth analysis. The Analytical Hierarchy Process is used to ensure that relative importance is established in a rigorous manner, and that requirements are structured hierarchically. The Blitz QFD® process encourages the analysis of the customer voice in order to build unambiguous statements about customer needs i.e. it builds the customer priorities into the foundation of the solution development process. The plusses and minuses of each approach are illustrated in

Table 10 Classical QFD vs Blitz QFD®.[17]

Traditional QFD Matrices

+	-
Exhaustive coverage	Exhausting to complete
Timeless	Time consuming, risk of giving up
Easily reusable	Not useful until completed, but only a small part is actionable. Not a good use of scarce resources.
Prevents items "falling through the cracks"	Predetermined elements lock in the existing paradigm
	Problematic math

Blitz QFD®

+	-
Faster time to complete	Once achieved, must start fresh on next run-through
Sense of focus on high value items	Marginal items may be delegated as "no change" for now
Can get started on improvements immediately. No need to wait until analysis is completed	
Upgradeable to Traditional QFD matrices with no loss of data or wasted effort. Can be used simultaneously.	
Math issues addressed	

Conclusion

Quality professionals have long looked at QFD as a powerful but time-consuming approach to translating the voice of customer into product, service, software, and process requirements and managing them through the flow-down to commercializa-

tion. Blitz QFD® offers a faster approach that can often replace, or at least compliment the effort. AHP improves the math in either approach and should replace any ordinal calculations you may have been taught. Readers seeking more information are encouraged to visit the authors website for more papers, including the ones cited below. The QFD Institute offers public classes, including MS Excel® templates for all the above tools. The author also offers in-company custom tailoring and training for those looking to better integrate QFD into their new product development process, whether it is based on DFLS[18], Stage-Gate®[19], or another approach.

About the author

Glenn H. Mazur, BA, MBA, QFD Red Belt® has been active in QFD since its inception in North America, and has worked extensively with the founders of QFD on their teaching and consulting visits from Japan. He is a leader in the application of QFD to service industries and consumer products, conducts advanced QFD research, and is the Conference Chair for the annual North American Symposium on Quality Function Deployment. Glenn is the Executive Director of the QFD Institute and International Council for QFD, Adjunct Lecturer on TQM at the University Of Michigan College Of Engineering (ret.), President of Japan Business Consultants Ltd., and is a senior member of the American Society for Quality (ASQ), and the Japanese Society for Quality Control (JSQC). He is a certified QFD Red Belt® (highest level), one of two in North America. He is a certified QFD-Architekt #A21907 by QFD Institut Deutschland. He is convenor of the ISO Technical Committee 69 Subcommittee 8 Working Group 2 to write an international standard for QFD. He is an academician of the International Academy for Quality. He is the honorary president of the Hong Kong QFD Association. Glenn@Mazur.net

References

[1] Akao, Yoji, ed. 1990. *Quality Function Deployment: Integrating Customer Requirements into Product Design.* Translated by Glenn Mazur. Cambridge, MA: Productivity Press. ISBN 0-915299-41-0 (originally published 1988 by Japan Standards Association)

Mizuno, S. and Akao,Y, ed. (1994): *QFD: the Customer Driven Approach to Quality Planning and Deployment*. Translated by Glenn Mazur. Asian Productivity Organization, (originally published 1978 by JUSE)

[2] Hepler, Carey W. and Glenn Mazur. 2008. "Predicting Future Health Insurance Scenarios using Quality Function Deployment (QFD) and Analytic Hierarchy Process (AHP). *Transactions of the 20th Symposium on Quality Function Deployment.* QFD Institute ISBN1-889477-20-6

[3] Zultner, Richard E. 1997. "Project QFD Managing Software Development Projects," *Transactions of the 9th Symposium on QFD*. QFD Institute. ISBN1-889477-09-5

[4] Saaty, T. L.1990, *Multicriteria Decision Making: The Analytic Hierarchy Process*, RWS Publications, 4922 Ellsworth Avenue, Pittsburgh, PA.

[5] Akao, Y. Editor 1991. *Hoshin Kanri - Policy Deployment for Successful TQM.* Translated by Glenn Mazur. Productivity Press. ISBN 156327311X (originally published1988 by Japan Standards Association)
Mazur, Glenn, Hisashi Takasu, and Michiteru Ono. 1998. *Policy Management – Quality Approach to Strategic Planning.* IQD Press. ISBN0-9-664655-0-4
[6] Stansfield, Cole, and Mazur. 2010. "Complex IT Design using both Traditional QFD and Blitz QFD®." *Transactions of the 22th North American Symposium on Quality Function Deployment and 16th International Symposium on QFD.* QFD Institute ISBN1-889477-22-2
[7] Grimm, Denavs, and Mazur. 2011. "Using QFD to Design a Multi-Disciplinary Clinic." *Transactions of the 23rd Symposium on QFD*. QFD Institute. ISBN1-889477-23-0
[8] Zultner, Richard and Glenn Mazur. 2006. "The Kano Model – Recent Developments." *Transactions of the 18th Symposium on QFD*. QFD Institute. ISBN1-889477-18-4
[9] Bylund, Wolf, and Mazur. 2009. "Reducing Lead Time in Cutting Tool Development by Implementing Blitz QFD®." *Proceeding of the International Conference on Engineering Design.* Stanford University.
[10] Childs, Stover, Serino, Bartlett, and Mazur. 2010. "DREAM/QFD to Re-Design Staff Service Excellence at Rutland Regional Medical Center." *Transactions of the 22th North American Symposium on Quality Function Deployment and 16th International Symposium on QFD.* QFD Institute ISBN1-889477-22-2
[11] *ibid.* Bylund, Wolf, Mazur. 2009.
[12] Hepler, Carey and Glenn Mazur. 2006. "Finding Customer Delights Using QFD." *Transactions of the 18th Symposium on QFD*. QFD Institute. ISBN1-889477-18-4
[13] Talbot, Hepler, and Mazur. 2011. "A QFD Process at Medtronic Diabetes." *Transactions of the 23rd Symposium on QFD*. QFD Institute. ISBN1-889477-23-0
[14] *ibid.* Saaty. 1990.
[15] Miller, George A. "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information." *The Psychological Review*, 1956, vol. 63, pp. 81-97.
[16] *ibid.* Grimm, Denavs, and Mazur. 2011.
[17] Watson, Mazur, Akao. 2011. "QFD Applications for the Board of Directors." *Transactions of the 23rd Symposium on QFD*. QFD Institute. ISBN1-889477-23-0
[18] Huber, Charles and Glenn Mazur. 2002. "QFD and Design for Six Sigma." *Transactions of the 14th Symposium on QFD*. QFD Institute. ISBN1-889477-14-1
[19] Mazur, Glenn. 2010. "Integrating QFD into Phase-Gate Product Design." *Transactions of the 22th North American Symposium on Quality Function Deployment and 16th International Symposium on QFD.* QFD Institute ISBN1-889477-22-2